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First-spike timing reveals the quantity of sound that drives the central auditory system: implications for psychoacoustics

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Current propositions of the quantity of sound driving the central auditory system to threshold include sound pressure, power, and energy, i.e. the integral of power over time. Analysis of the timing of the first spike of auditory-nerve fibers and central auditory neurons following the onsets of stimuli resolves the issue in favor of integration of the pressure envelope over time, and rules out models of a fixed pressure threshold, a fixed power threshold, or an energy threshold. These findings have implications, and make testable predictions, for perceptual thresholds, which are generally thought to arise from temporal integration of sound power.